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(54) Title: CHARACTERISATION OF INTERNAL COMBUSTION ENGINES BY THE OPTICAL MEASUREMENT OF A PLURALITY OF QUANTITIES IN THE COMBUSTION CHAMBER

(54) Bezeichnung: CHARAKTERISIERUNG VON BRENNKRAFTMASCHINEN DURCH OPTISCHE MESSUNG MEHRERER GRÖSSEN IM BRENNRAUM

(57) Abstract

The operation of internal combustion engines depends considerably upon quantities which cannot be set accurately enough from outside, e.g. the stoichiometry of the fuel-air mixture before ignition, the proportion of exhaust gas in this gas mixture and its temperature. The most simultaneous and precise measurement possible of these quantities in the combustion chamber helps greatly to explain engine problems. The novel laser Raman light scatter process, for instance, permits this measurement. The process is contactless and provides good time (i.e. crank angle) and position resolution. Intense pulsed u/v lasers are used as the excitation light source for the Raman and Rayleight scatter. The laser light (1) passes through a window (17) in the wall of the cylinder being measured into the upper part of the combustion chamber, especially to analyse the final gas before ignition. The laser-induced emissions (especially the Raman and Rayleigh scatter) can be brought out from the combustion chamber in various ways, e.g. via the same window (17) and a dichroic mirror (18). The various emissions, especially the Raman emissions from fuel, oxygen, nitrogen, water, etc., are quantitatively and simultaneously measured by intensified short-time cameras (CCD) combined with upstream wavelength separation (spectrometer) (8). It is thus possible also to obtain local resolution along an axis in the combustion chamber. The excitation wavelength in the u/v permits high-precision single-pulse measurements so that the small cyclic fluctuations in the mixture formation (and combustion) in the engine can be resolved. In many cases, moreover, it is necessary to separate the Raman emission from interfering (fluorescent) emissions, and this is done with the aid of polarisation properties. The quantities relevant to combustion like stoichiometry and proportion of exhaust gas are found by calculating the ratio of Raman intensities, which produces high accuracy of measurement.